

REMARKS

By this amendment, independent claims 1 and 12 have been amended to incorporate limitations of respective dependent claims 10 and 20, which have been canceled, and dependent claims 11 and 21 have been amended. As a result of the above amendments, no new claim language requiring a search or further consideration has been introduced. Thus, claims 1-9, 11-19, and 21 remain pending in the present application. Reconsideration and allowance of pending claims 1-9, 11-19, and 21 in view of the following remarks are requested.

The Examiner has rejected claims 1-5, 8-16, and 19-21 under 35 USC §102(e) as being anticipated by U.S. patent number 6,492,711 to Takagi et al. ("Takagi"). For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claims 1 and 12, is patentably distinguishable over Takagi. However, Applicant reserves the right to provide declarations and/or documents under 37 CFR §1.131 to "swear behind" the effective filing date of Takagi.

Subject to Applicant's reserved right to establish priority of the present invention under 37 CFR §1.131, Applicant submits that the present invention, as defined by amended independent claim 1, teaches, among other things, a concentration of a second material having a step increase at a first depth in a base so as to counteract a change in band gap caused by a concentration of a first material at the first depth, "wherein said band gap decreases at a linear rate between a second depth in said base and a third depth in said base, wherein said first depth is situated between said second depth and said third

depth.” As disclosed in the present application, a concentration of a material, such as germanium, is stepped up, i.e. abruptly increased, at a first depth in a base of a silicon-germanium (SiGe) heterojunction bipolar transistor (HBT) to compensate for the introduction of a dopant diffusion suppressant, such as carbon, at the first depth. Also, as disclosed in the present application, the concentration of the material, such as germanium, increases linearly between a second depth and the first depth in the base and between the first depth and a third depth in the base, where the first depth is situated between the second depth and the third depth.

As a result of the abrupt, i.e. step, increase in the concentration of the material at the first depth to compensate for the introduction of the dopant diffusion suppressant at the first depth, the present invention provides a linear decrease in band gap from the second depth to the third depth in the base. Accordingly, the present invention advantageously provides a constant electric field, i.e. an electric field without a discontinuity, from the second depth to the third depth in the base. By providing a constant electric field from the second depth to the third depth in the base, the present invention advantageously achieves a corresponding increase in HBT performance.

In contrast to the present invention as defined by amended independent claim 1, Takagi does not teach, disclose, or suggest a concentration of a second material having a step increase at a first depth in a base so as to counteract a change in band gap caused by a concentration of a first material at the first depth, “wherein said band gap decreases at a linear rate between a second depth in said base and a third depth in said base, wherein

said first depth is situated between said second depth and said third depth.” Takagi specifically discloses a SiGeC-HBT including SiGeC layer 4, which acts as a base and includes bottom layer 4b, center layer 4a, and top layer 4c, Si layer 5, which acts as an emitter, and Si epitaxial layer 20, which acts as a collector. See, for example, column 21, lines 18-28 and Figure 13b of Takagi. In bottom layer 4b of SiGeC layer 4 (i.e. the base), the Ge (germanium) and C (carbon) contents gradually decrease in the direction from center layer 4a of SiGeC layer 4 to the collector (i.e. Si epitaxial layer 20) and in top layer 4c of SiGeC layer 4 (i.e. the base), the Ge and C contents gradually increase in the direction from the emitter (i.e. Si layer 5) to center layer 4a. See, for example, column 21, lines 29-35 and Figure 13b of Takagi.

Thus, in Takagi, the Ge content in SiGeC layer 4 (i.e. the base) does not increase abruptly at a first depth in the base so as to counteract a change in band gap at the first depth caused by the introduction of a diffusion impeding material, such as carbon. Furthermore, Takagi fails to teach, disclose, or suggest a concentration of a second material having a step increase at a first depth in a base so as to counteract a change in band gap caused by a concentration of a first material at the first depth, where the band gap decreases at a linear rate between a second depth in the base and a third depth in the base, where the first depth is situated between the second depth and the third depth.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 1, is not suggested, disclosed, or taught by Takagi. As such, the present invention, as defined by amended independent

claim 1, is patentably distinguishable over Takagi. Thus claims 2-5, 8-9, and 11 depending from amended independent claim 1 are, *a fortiori*, also patentably distinguishable over Takagi for at least the reasons presented above and also for additional limitations contained in each dependent claim.


The present invention, as defined by amended independent claim 12, teaches a method for fabricating the heterojunction bipolar transistor disclosed in amended independent claim 1. Thus, for similar reasons as discussed above, amended independent claim 12 is also patentably distinguishable over Takagi. As such, claims 13-16, 19, and 21 depending from amended independent claim 12 are, *a fortiori*, also patentably distinguishable over Takagi for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 6-7 and 17-18 under 35 USC §103(a) as being unpatentable over Takagi. As discussed above, amended independent claims 1 and 12 are patentably distinguishable over Takagi and, as such, claims 6-7 depending from amended independent claim 1 and claims 17-18 depending from amended independent claim 12 are, *a fortiori*, also patentably distinguishable over Takagi for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Based on the foregoing reasons, the present invention, as defined by amended independent claims 1 and 12 and claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims 1-9, 11-19, and 21 pending in the present application are patentably distinguishable over the art cited by the Examiner. As such, and for all the foregoing reasons, an early allowance of claims 1-9, 11-19, and 21 pending in the present application is respectfully requested.

Respectfully Submitted,
FARJAMI & FARJAMI LLP

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Michael Farjami, Esq.
Reg. No. 38, 135

Michael Farjami, Esq.
FARJAMI & FARJAMI LLP
16148 Sand Canyon
Irvine, California 92618
Telephone: (949) 784-4600
Facsimile: (949) 784-4601

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